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ABSTRACT

Surveys of educational needs have revealed an under-supply of teachers trained to teach handicapped students. In 1969 Pennsylvania State University founded a program to instruct teachers in curriculum development and the delivery of services for handicapped students. Since the aim of the program was to develop a model to deliver such instruction to large numbers of teachers in remote areas, a mobile computer-based laboratory was selected as the mode of delivery. This paper discusses the project from three perspectives: (1) the funding agency; (2) the central administration of the University, and (3) the operating unit. (EMH)

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COSTS OF CAI FOR SPECIAL EDUCATION TEACHER TRAINING: THREE PERSPECTIVES

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The Bureau of Education for the Handicapped, United States Office of Education, is charged with assisting the states in providing appropriate educational services for all handicapped children in the United States. The BEH Annual Report for the Fiscal Year 1969 attested to a strong need for additional personnel to work with handicapped children and youth. During the school year 1968-70, over "3.7 million (62 percent) of the Nation's 6 million handicapped children received no appropriate educational services." (1) An additional 266,000 trained persons were needed but not available in 1968-69 in order to provide special services to the 3.7 million handicapped children needing but not receiving special educational services.

It was clear that new models for training professional personnel to work with handicapped children were needed. James J. Gallagher, formerly Associate Commissioner of the Office of Education, stated that the (then) present programs for training specialists to work with the handicapped were good but that they simply could not keep up with the need. He indicated that the 1969 rates of preparation were such that it would take 800 years to produce enough teachers to provide appropriate educational services for emotionally disturbed children. (2)

Since that time, parent, congressional, and court pressures have been successful in increasing the number of trained professionals but not nearly to the extent that is commonly believed. For example, in the age group 6-19 (the traditional school age range) the best estimate is that 6.7 million children are handicapped to such an extent that special educational services are called for. In 1975-76, fully 42 percent of that group--2.8 million children--did not receive the services which are mandated by law. The trend now is to provide special services to very young children in an attempt to precent or diminish problems resulting from handicaps. In 1975-76, 62 percent of the handicapped children under the age of 6 were unserved. (3)

Although the number of children who require special education services is small compared to those children who can benefit from conventional instruction, costs are much greater for special education programs than for conventional programs. For example, Frohreich (4) reports that the average per pupil costs in several North Eastern states is about $850 per child per year in regular education programs. Per pupil expenditure for learning disabled and

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emotionally disturbed children is double that figure, $1,700 per year. Costs of visually impaired and physically handicapped children are in excess of $2,000 per year.

It is popular today to talk about the oversupply of teachers. These statistics related to the handicapped speak for themselves: there is no oversupply of special education teachers and other professional personnel trained to work with the handicapped.

A PARTIAL SOLUTION

Directly in response to the urgent need to prepare additional teachers to work with handicapped children, in 1969 Penn State embarked on a program to use computer technology to assist in training regular teachers to work with mildly handicapped children.

In 1969, personnel at The Pennsylvania State University conceptualized an alternate method of preparing teachers to provide adequate educational services to preschool and elementary age mildly handicapped children. The program was designed as an "add-on" system to capitalize on the increasing numbers of trained elementary school teachers who would become available as the population curve flattened and decreasing percentages of elementary age children reached the elementary school. The idea behind the approach was that provision of additional trained personnel to work in preschools and day care centers would facilitate the prevention of the onset of serious learning problems in children. Training regular classroom teachers to work with handicapped children in the regular classroom might ameliorate existing and incipient learning problems early in a child's school experience.

Under grant and contract support from the Bureau of Education for the Handicapped, Office of Education, we developed a series of computer assisted instruction (CAI) courses in special education to prepare preschool and inservice teachers to identify and deal effectively with conditions which might adversely effect school performance. (5, 6) The series of courses was labeled CARE (Computer Assisted Remedial Education). They were designed to be completely self-contained, college level, CAI courses. The courses were behavioristic in orientation and were designed to develop in education personnel a diagnostic awareness and understanding of strength and weaknesses of handicapped and normal children. The CARE courses are oriented toward preschool and primary level teachers. The curriculum and philosopy have been described in detail elsewhere. (7, 8, 9, 10, 11)

There were two separate phases to the series of projects supported by the Office of Education: curriculum development and delivery of services. The curriculum was conceptualized in such a manner that it would be "method-free," that is, so that the method of delivery of the curriculum content would not influence the choice of content. However, it soon became apparent that it was not realistic to develop a curriculum in that manner. Therefore, very early in the initial project, the advantages and disadvantages of the intended delivery system were kept in mind during the curriculum development phase.

TARGET POPULATION

The target population was fairly well defined from the start. The materials were developed to be interesting and useful for experienced elementary school teachers. Our goal was fairly clear: to provide experienced, certified elementary school teachers with knowledge and skills to assist them in (1) identifying mildly handicapped children in the regular classroom, and (2) intergrating and working with mildly handicapped children in the regular classroom. Mildly handicapped children were defined, for example, as educable mentally retarded children with IQ's greater than about 60 whose behavior was such that they could profit from regular classroon instruction; blind or partially sighted youngsters who had received training in special classes and were eligible to return to regular classes provided that their teacher received some information and training in dealing with blind and partially sighted youngsters; mildly disturbed youngsters who needed assistance in managing their behavior appropriately in regular classrooms; and mildly physically handicapped. Specifically excluded were severely and profoundly retarded youngsters; severely emotionally disturbed or maladjusted youngsters, deaf children, and young blind children receiving instruction primarily through braille. Thus, the target group of children were those mildly handicapped youngsters who it is felt can profit by integration in to regular classroom situations provided they receive some additional services from trained professional personnel. The target population for which our courses were designed were regular classroom teachers who might be called upon to work with mildly handicapped youngsters.

REASON FOR SELECTING COMPUTER ASSISTED INSTRUCTION

At the bare minimum, it was decided that elementary teachers needed two full length college level courses to provide them with the basic skills and information necessary to help them work more effectively with mildly handicapped children. Most college and universities provide about 15 clock hours of classroom instruction for each semester hour of academic credit. Usually, college courses carrying three semester hours of credit offer about 45 clock hours of classroom instruction plus an indeterminable number of hours of study time on the part of the student outside of class. Our bare bones requirement of two college courses would have required approximately 90 clock hours of conventional instruction over a 12-16 week period on the campus of a college or university.

We (my colleague Harold E. Mitzel deserves most of the credit for the early conceptualization of the mobile system) concluded that it was not reasonable to expect experienced elementary school teachers all across the nation to give up their summers or other times in order to take a minimum of two courses on a college campus. Furthermore, it was concluded that the level and content in instruction across the nation would be extremely variable. Thus, the parameters for selection of an alternate method of instruction began shaping up: first, a method convenient to the teachers was required to provide the curriculum content to them. Second, an up-to-date curriculum consistent across the states and acceptable to educators was required. Third, a consistent method of instruction which would yield similar results in varying parts of the nation was required. The third parameter, consistency, was clearly a vote for some kind of technology based delivery system. The first parameter, convenience to teachers, suggested that the delivery

system must be a true delivery system in the sense that the curriculum would be delivered to the teachers in their own areas, if not in their homes, rather than uprooting the teachers and bringing them to a central university location. The criterion of convenience presupposes individualization of instruction. It is almost inconceivable to think of instruction which is time and space convenient which is not individualized. Thus, it was essential that a delivery system to able to penetrate areas remote from college campuses. Finally, the second criterion, acceptability and applicability of curriculum, though not necessarily dependent on a particular system, needed to be unbiased and free from the pet theories and idiosyncrasies of individual professors. That parameter required a great deal of personal commitment on the part of the principle professional persons involved in the curriculum development.

Based on these parameters and other relevant considerations the decision was made to develop a mobile computer assisted instruction facility to offer the CARE courses. At the time of the initial proposal for funding of the curriculum development, 1968-69, there were relatively few choices of complete CAI systems. Penn State had already made the decision (1967) to go with the IBM 1500 system. The CARE curriculum developers were concerned with providing a maximum of interface options as well as cathode ray tube graphics. The authors felt that it was essential to have as many "bells and whistles" as possible available to keep the teachers interested. CAI people often forget that some of their potential audiences, in this case teachers and other educational personnel, may not be nearly as enamored with the elegance of the operating system or the power of the computer language as they are. Our experiences have shown that we need a variety of interface devices and programming techniques to keep people motivated when they are required to spend an average of thirty clock hours per semester course in front of the computer terminal.

Early in the curriculum development process, a decision was made that the courses would be offered out in the field at considerable distances from the home university without the on-site assistance of anyone knowledge in the curriculum area. We planned to offer full length courses in special education in areas quite a distance from the university without the assistance of a professor of special education at the site. Therefore, it was extremely important that the curriculum be very carefully designed and that maximum effort be taken toward off potential problems before they occurred. Consequently, we spent considerable time field testing and revising the materials before they were ever released for general usage. This point, I believe, illustrates that an additional objective not normally associated with conventional college instruction was added to the curriculum objectives for the CARE courses. That is, in a conventional course taught be live human instructors, the instructors are there all the time to present the information. An objective of the CARE courses was to present the materials in a location where it was not possible for the conventional instructor to be present at all times. This, of course, is not a knowledge objective, but is certainly a new curricular approach. Note that initially the CARE materials were designed to be used away from the main campus without the assistance of a live instructor. In the meantime, the same courses were to be taught at the main campus using conventional techniques.

Another objective which is not possible under a conventional instructional system, is to make the curriculum available to teachers at their convenience. The mobile CAI facility was made available seven days per week, day and night. Thus, teachers could schedule their own times according to their particular needs. Finally, and again this is a delivery system objective and not a knowledge objective, provision of instruction at locations away from the main campus was made possible through the mobile CAI facility.

NATURE OF THE TECHNOLOGY

By 1971, when the mobile facility hit the road the CAI technology was not new. The CAI system had been in use in numerous locations for several years. The mobile facility at least in our application was quite new. Again with grant support from the Office of Education and from the Penn State Foundation, a specially designed van was designed and constructed to house the computer system and 16 student stations. Figures 1 and 2 show interior and exterior views of the van. In the years to come two more vans were constructed. In the 1975-76 academic year, three vans were available for instruction throughout the nation. The concept was that one of the vans would be hauled to a location in a rural area (or as it turned out in numerous urban area) and parked for a period of seven or eight weeks. During that time, approximately a hundred teachers can complete a three credit course be scheduling time at their convenience. About thirty clock hours (standard deviation of 6 hours) is required to complete a course. More details about this concept are available elsewhere. (10, 12, 13)

Obviously, when comparing the costs of this mobile method of instruction with conventional on campus instruction, two separate considerations should be kept in mind. First of all, the cost of the professor is subtracted out of the CAI system whether or not it is located on campus or in a mobile facility. Secondly, when comparing CAI on campus and a mobile facility, it is obvious that considerable relocation costs are required. It is necessary to provide for the relocation, housing, and meals plus salary for a computer operator. A proctor must be on duty for an additional 40 hours per week. The cost of relocating the van itself cost upwards of a $1/mile.

There is no question that it is much cheaper to have a graduate student or assistant professor at a main campus location offer a conventional course to 100 students each with class time being 9:00 a.m. Monday, Wednesday and Friday for 16 weeks than it is to provide a mobile CAI facility. On the other hand, a dollar value cannot be placed upon the convenience factor for the teachers. However, it would be considerably more expensive to have instruction available from a live instructor at any time of the day or night seven days per week.

SOME SPECIFIC COSTS

The sub title of this paper is "Three Perspectives." The three perspectives about costs are from 1) the funding agency; 2) the central administration of the university; and 3) the operating unit (CAI laboratory).

The following cost analyses may appear to be oversimplified and

from one point of view, they are. However, keep in mind that these same simple figures have been used by non-CAI people as data for some important decisions.

First, let's look at the costs as reported by the CAI lab director. (14) As of the end of May, 1976, the Penn State mobile CAI laboratory had served 4,840 teachers; i.e. 4,840 teachers had completed at least one of the CARE courses for university or inservice credit. Those 4,840 teachers received 13,930 credit hours. (Incidentally, student credit hour or student semester hour is a reasonable comprehensive unit and may be more desirable for reporting purposes than clock hours). Professor Hall's data are based on several characteristics and parameters. He assumes that an eight week site with 15 student stations operating 90 clock hours per week (including evenings and weekends) will result in about 7,500 terminal hours given 70 percent utilization of the stations. Approximately 30 clock hours is required for a course completion so that it is possible for 250 people to complete one course in the eight weeks. Allowing time for set-up and short moves, six full eight week settings in a twelve month year is possible. Thus, 1,500 course completions or approximately 4,500 student credit hours is possible in a single year with one van. Penn State has had one mobile system operating for five years and a second van operating for two years for a total of seven "van" years. Thus, hitting the seventy percent utilization figure should result in a total number of course completions of 10,500 students and approximately 31,500 student credit hours. Unfortunately, a number of factors have prevented the facilities from operating near that rate and the actual figures show that about 45 percent of the theoretical optimum level have been produced.

Professor Hall reports that the annual operating expense for a single van is about $90,000/year. That figure includes $25,000 for personnel, $30,000 for computer and van maintenance, $9,000 for relocation and electrical hook-ups, $5,000 for instructional materials, and $20,000 for curriculum services. Note that his figures do not include lease or purchase of the van and computer system (approximately $600,000) nor of curriculum development costs (in this instance, approximately $600,000).

Dividing the theoretical optimum of 1,500 course completions (4,500 student credit hours) by the annual operating cost of approximately $90,000 results in a cost per credit hour of $20. The average credit hour on our system requires approximately 10 clock hours of CAI instruction. Therefore, this estimate results in about $2/ clock hour for CAI instruction. Note that this perspective is based on the annual situation in which most computer and curriculum costs are fully amortized or paid by someone else and that maximum usage of the system has been achieved.

The second perspective of costs of CAI is that of the funding agency. Since the beginning of the CARE projects, the CAI courses have been supported almost exclusively through the Office of Education. The Bureau of Education for the Handicapped and the former Bureau of Educational Personnel Development were approximately equal partners in dollar support over a six year period. After six years of support, effective July 1, 1976, the Office of Education decided to withdraw support and phase out its involvement within the year. Discussions with the decision makers of that Bureau revealed an understandable

but somewhat simplistic interpretation of the costs. They simple totalled up the number of dollars given to Penn State over the years for the CARE projects and divided those dollars by the number of student credit hours produced through the program. From 1969 through June 1976, the Penn State CAI laboratory received approximately $2,650,000 from the Office of Education for the support of its CARE CAI curriculum development and operational activities. (several million dollars for other projects from a variety of sources were awarded to Penn State over the past decade but those projects were only tangentially related to the CARE projects). About $600,000 of that was for initial curriculum development, and the remaining $2,000,000 was for putting the courses into the field where they could be taken by teachers. As of the end of May, 1976, the CARE courses offered through mobile computer assisted instruction have produced a total of 13,930 student credit hours. Dividing the $2,650,000 by the $13,930 student credit hours yields a credit hour cost of approximately $191 and a cost of about $19 per clock hour of terminal time. Thus, there was a discrepancy of approximately $170/credit hour between the actual cost as calculated by the Federal government and the reported estimated costs reported by the CAI laboratory director. Actually, the Office of Education interpretation should be discounted somewhat in light of the fact that some additional objectives were proposed in the operational phase which accomplished other goals that do not produce student credit hours. Also, it could be argued that the curriculum development cost (approximately $600,000) should be amortized across all students who have participated in the CARE projects rather than just those who took the CARE courses in the mobile laboratory. (14) Hall reports that approximately 9,500 students have received 27,000 credit hours from the CARE courses. Amortizing the $600,000 course development costs across all those students yields a figure of approximately $22 per student credit hour for the course development. Therefore, that simplistic figure of $191 per student credit hour could be reduced accordingly. On the other hand, neither Dr. Hall's nor the Office of Education figures reflect other costs which went into the offering of the CAI courses. Penn State has put some foundation money into the operation, many students have paid a $10 per credit fee, and local sponsoring agencies have paid for electrical power and proctoring in many cases.

Regardless of which figure is used ($147/ student credit hour excluding course development costs or $169/credit hour with course development costs amortized over all students who have taken CARE courses at any site), the Office of Education points out that those costs are considerably higher than the average university expenditure per credit hour across the nation. The United States Government Printing Office Publication Projections of Education Statistics to 1984-85 indicates that the average university expenditure per student credit hour in 1970-71 was $70.43. (15) During the intervening years, that figure has increased dramatically to a figure of $115 per student credit hour in 1975-76. (15) Thus, the simplistic comparison indicates that the mobile CAI operation is considerably more expensive than the more conventional university instruction. However, that comparison does not take into account the convenience and individualization factors or the site of the instruction.

The third perspective is that of the Penn State central administration. About a year ago, the Provost's office of the university decided to undertake a close look at the CAI operation at Penn State. University

money had been used to purchase an IBM 1500 instructional system for the use of the CAI resident instruction program and the purchase of one of the vans. Those expenditures for hardware plus the continued use of university faculty and staff for the resident instruction program was deemed to be sufficient grounds for a review of internally and externally funded CAI activities at Penn State. A committee was formed and Professor Harry Zook was asked to chair the committee. The Zook committee studied the CAI activities and eventually reported to the Provost. Unfortunately, neither the committee report or the Provost's report have been made public. However, some preliminary reports have been made available and the committee has released some costs on enrollment data for CAI activities based upon a proposal submitted by Penn State to the Office of Education. The committee was extremely thorough in its review of CAI at Penn State. They also reviewed a lot of available literature and visited CAI installations at other universities. This committee chose as a base figure (number of student credits produced per year) a figure intermediate between that reported as optimal by Hall, (14) and the average number of actual students trained during the previous five years of operation. The Zook Committee report yields a figure of $88.40 per student credit hour or approximately $8.40 per student terminal hour in the mobile facilities. Comparable figures for a stationary site (campus) yields a figure of $56.10 per student credit hour (and $5.61 per student terminal hour) for leased equipment or $33.20 per student credit hour ($3.32 per student terminal hour) for equipment purchased and amortized over a five year period.

CONCLUSIONS

I'm not sure just what conclusions, if any, are warranted by this excerise; but I will hazard two. First it has long been clear that simplisitic interpretations of data such as the simple dollars in-students out paradigm are not especially useful. Such global statistics are empty if not misleading. It is imperative that strenuous efforts be made to spell out all assumptions when dealing with CAI costs. The second conclusion is really an extension of the first. The potential user of CAI facilities needs to be extremely careful when reviewing the CAI cost data. It is essential that such assumptions have been carefully specified in advance. Otherwise he may find himself making decisions on the basis of promise rather than fact.

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A major time commitment over the last five years has been the development of the CARE series of college level computers assisted instruction courses for training educational personnel to work with handicapped children.

REFERENCES

1) Bureau of Education for the Handicapped. Better Education for Handicapped Children: Annual Report, Fiscal Year 1969. Washington, D.C., (US6PO), 1970.

2) Gallagher, J.J., The search for the educational system that doesn't exist. Exceptional Children Conference papers: The Improvement of Special Education Through Instructional Technology. Council for Exceptional Children: Arlington, Va., (Ed047442), 1970.

3) Education of the Handicapped Today. American Education: Vol. 12, No. 5, pp. 6-8, June, 1976.

4) Frohreich, L.E., Costing Program for Exceptional Children: Dimensions and Indices. Exceptional Children. Vol. 39, No. 7, pp. 517-524, 1973.

5) Cartwright, G.P. and Cartwright, C.A., Training Early Childhood Educators: Computer Assisted Instruction Courses in Diagnostic Teaching. Final Report, Vol. 1 of 4 volumes, to Bureau of Education for the Handicapped. The Pennsylvania State University, 1974.

6) Cartwright, G.P. and Mitzel, H.E., Computer Assisted Remedial Education: Early Identification of Handicapped Children. Final Report, Vol. 1 of 5 volumes, The Pennsylvania State University, University Park, Pa., 1971.

7) Cartwright, C.A., Cartwright, G.P., and Robine, G.G., CAI course in the early identification of handicapped children. Exceptional Children, February, 1972, pp. 453-459.

3) Cartwright, G.P. and Cartwright, C A., Gilding the lilly: Comments on the training based model. Exceptional Children, pp. 231-234, 1972.

9) Cartwright, G.P., Cartwright, C.A., and Ysseldyke, J.E., Two decision models: Identification and diagnostic teaching of handicapped children in the regular classroom. Psychology in the Schools, January 1973, 10 (1), pp. 4-11.

10) Cartwright, G.P. and Cartwright, C.A., A computer assisted instruction course in the early identification of handicapped children. Journal of Teacher Education, 1973, 24 (2), pp. 128-134.

11) Cartwright, C.A. and Cartwright, G.P., Competencies for prevention of learning problems in early childhood education. Educational Horizons, 1975, 53 (4), pp. 151-157.

12) Hall, K.A., Mitzel, H.E. and Cartwright, G.P., A triumph for CAI education. Phi Delta Kappan, 1974, 56, pp. 70-72.

13) Hall, K.A. and Mitzel, H.E. CARE: Computer assisted renewal education - an opportunity in Pennsylvania Audio Visual Instruction, 1973, pp. 35-38.

14) Hall, K.A., The development and utilization of mobile CAI for the education of nurses in remote areas. Paper presented at the 1976 AERA Annual Meeting, San Francisco, 1976.

15) Simon, K.A. and Frankel, M.M., Projections of Education Statistics to 1984-85. National Center for Education Statistics, U.S. Department of Health Education, and Welfare. U.S. Government Printing Office, Washington, D.C., 1976.